

# Mastoid Obliteration with Postconchal Soft Tissue and Postauricular Pericranial Flap

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**Objective:** To report the technique and the result of mastoid obliteration with postconchal soft tissue and postauricular pericranial flap

**Material and Method:** Retrospective chart reviews were performed in the patients who underwent mastoid obliteration after canal wall-down mastoidectomy by the first author in the Department of Otolaryngology, Faculty of Medicine Siriraj Hospital, Mahidol University between January 2004 and January 2008.

**Results:** Fifteen patients were included in the present series. All patients had final round dry cavities within six to eight weeks except one who had wet discharging cavity from accumulated keratin because of total flap atrophy. Some atrophic change at the distal part of the flap was found in five cases (33%) resulting in small pockets at attic and aditus area after a 6-month follow-up period.

**Conclusion:** Postconchal soft tissue and postauricular pericranial flap were reliable for mastoid obliteration. The new cavity was finally round, dry, and healthy. It could be simply accessed, cleaned, and examined for recurrent disease during the follow-up period. Some shrinkage of the flap could be expected at the distal part after the 6-month follow-up period.

**Keywords:** Mastoid obliteration, Canal wall-down mastoidectomy

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Mastoidectomy is performed to remove the disease in the mastoid cavity, especially cholesteatoma. Generally, with an attempt, the posterior wall of the external auditory canal is preserved to make an easy care for canal with normal resonance, and to facilitate the hearing aid usage. However, removal of the canal wall is sometimes not avoidable in order to get rid of all the disease. After canal wall down mastoidectomy, mastoid obliteration is indicated to reduce the dead space of the mastoid cavity, facilitate the canal care, restore the near normal canal resonance, prevent the posterior retraction and accumulation of the infected keratin. Many tissues and substances have been reported as used for this purpose such as soft tissue, muscle, periosteum, fat, cartilage, bone chips, bone pate', hydroxyapatite cement, and the pre-planned en bloc posterior bony canal wall<sup>(1-8)</sup>. The authors reported their technique to obliterate the mastoid cavity after canal wall-down mastoidectomy with postconchal

soft tissue and postauricular pericranial flaps. The procedure was in a single stage with the reliable and easily taken regional viable flaps for lining in the mastoid cavity.

## Material and Method

A retrospective chart review was conducted after an approval from Siriraj Institutional Review Board (SIRB). Consecutive series of mastoid obliteration procedure operated in two groups of the patients who had canal wall-down mastoidectomy from chronic otitis media with cholesteatoma or uncontrolled discharging mastoid cavity from the previous operation were collected. All patients were operated on by the first author between January 2004 and January 2008 with following period of at least six months. The final outcome measures were the status of the mastoid cavity and the complications. Data collection included demographic data of the patients, types of the flap and recurrence of the problem.

## Surgical technique

The authors' surgical technique for mastoid obliteration consisted of two types of random pedicle

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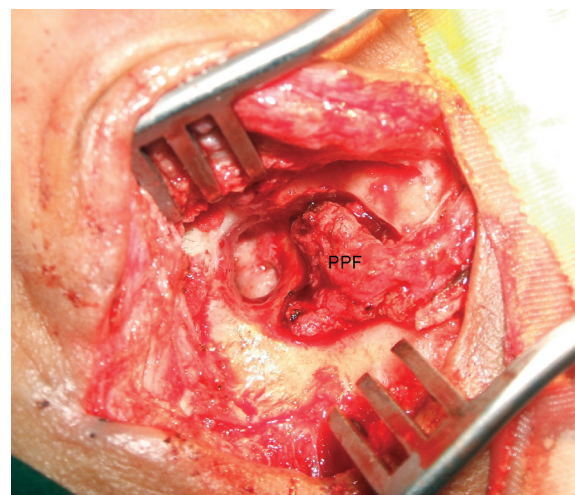
flaps, which were the postconchal soft tissue flap and the postauricular pericranial flap. The procedure was started with Koerner's flap incision at 12 o'clock and 6 o'clock in the external auditory canal. Koerner's flap was mobilized after making a distal incision to combine both previous incisions together. An incision was made 5-10 mm. posterior to the postauricular skin crease and directly from skin to periosteum in order to keep the bulkiness of the soft tissue at the back of the auricle. The authors' technique to take the postconchal soft tissue pedicle flap was modified from the original technique of Mosher<sup>(9)</sup>. The anterior incision rim was held by hooks, then soft tissue from the back of the auricle was dissected out from the conchal cartilage anteriorly while preserving a thin layer of soft tissue attached with the covering skin. Superiorly and inferiorly, the soft tissue flap could be dissected up/down and undermined beyond the incision edge as much as possible. The postconchal soft tissue flap could be designed by keeping the pedicle attached superiorly or inferiorly. The estimated size of the postauricular soft tissue flap could be as big as 10 x 40 x 7 mm.

The postauricular pericranial flap was taken by holding the posterior incision rim with two hooks while keeping the pericranium attached to the mastoid cortex. The covering skin, with a thin layer of subcutaneous tissue, was dissected out from the underlying tissue in all directions. The pericranial flap was designed in a droplet shape, dissected from the mastoid cortex with superior or inferior pedicle depending on the selected obliteration area.

The superior pedicle flap facilitated obliteration in the attic and antrum area while the inferior pedicle flap targeted on the middle and inferior part of the mastoid. In unplanned cases, the postauricular pericranial flap could also be taken after the mastoidectomy procedure but this took more time because of the donor flap floating away from the dissected mastoid cortex.

The postauricular pericranial flap consisted of layers of subcutaneous tissue, posterior auricular muscle, loose connective tissue, and Galea aponeurotica with some part of occipital belly, and some fleshy muscle fiber and tendon of sternocleidomastoid muscle. Slight shrinkage of the flap was noticed after it was taken from the underlying mastoid bone. It finally could be as big as 6 x 2 x 0.7 cm. The amount of the flap was enough to obliterate or at least down size the mastoid cavity. It also had all the bare area of mastoid cavity covered with the healthy tissue.

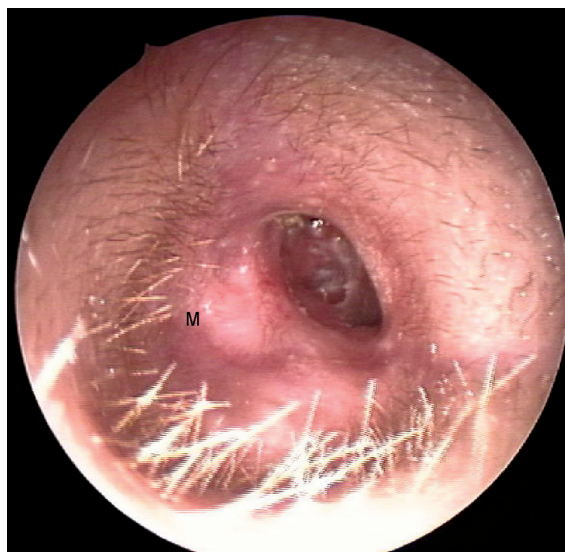
Canal wall-down mastoidectomy was carried out with standard technique. The posterior wall of the external ear canal was removed to create a good exposure for getting rid of all the disease in the middle ear cleft, including the facial recess, sinus tympani, attic, aditus, and antrum. Care must be taken to totally remove all of cholesteatoma matrix from the mastoid cavity before the obliteration procedure. The obliteration flaps were mobilized to lie down on the mastoid cavity with an attempt to cover all the bare area (Fig. 1). Decision to use which flap depended upon the status and size of the mastoid cavity. Usually, the authors preferred to use the superior pedicle postauricular pericranial flap for obliterating primarily the attic and antrum area while the inferior pedicle flap targeted on the lower half of the mastoid. If there were still naked area or substantial space in the mastoid bowl, the authors would use the combining superior or inferior postconchal soft tissue flap to enhance the obliteration. The distal canal skin should be spread out to cover on the obliteration flaps in order to prevent possible cholesteatoma collection from migrating of squamous epithelium underneath. The meatoplasty was performed and adjusted to the obliterated level. The Koerner's skin flap was placed back on the obliteration flap. The canal packing was designed with rayon and rose bud for a period of 10 to 14 days before removal. Follow-up was set up in every week for two weeks and every two weeks for a month and then every month for two months. If the patient finally had a dry cavity, an appointment would be made every three months or as needed in order to look for keratin accumulation and maintain the dry cavity.



**Fig. 1** The superior base postauricular pericranial flap (PPF) was placed on the mastoid cavity

## Results

Fifteen patients were operated on during the study periods. There were nine males and six females whose age ranged from nine to eighty-one years. Table 1 shows details of each patient including indication, type of flaps, and result of the final external ear cavity. Follow-up period ranged from six to 42 months. All patients had a good dry external ear cavity except one who had a discharging ear due to accumulated keratin. The healing period took about six to eight weeks before getting a satisfactory dry cavity. The postauricular wound healed nicely without any morbidity at the donor site. The external ear cavity looked near normal in shape and size, and was mostly larger than the previous one (Fig. 2). The pockets in attic, aditus, antrum, and sinudural angle were successfully obliterated and replaced with substantial healthy tissue as well as healthy skin covering. Some degree of atrophic change of the flap was noticed in five cases (33%) after the six-month follow-up period. It occurred mostly at the distal part resulting in small pockets at



**Fig. 2** Endoscopic view of the external auditory cavity showed a large dry round shape and healthy canal after the obliteration (M = area of obliterated mastoid)

**Table 1.** Details of the patients

Age (year)	Sex	Side	Indication	Type of flap	Final result	Duration of follow-up	Time to dry cavity	Remark
25	M	L	COM with cholesteatoma	sup PPF	Dry cavity	29 months	8 months	
12	F	R	COM with cholesteatoma	sup PPF	Dry cavity	10 months	6 weeks	
71	F	R	COM with cholesteatoma	sup PPF & sup PCF	Dry cavity	24 months	8 weeks	
21	M	L	COM with cholesteatoma	inf PPF & sup PCF	Dry cavity	7 months	6 weeks	Distal flap atrophy
17	M	R	COM with cholesteatoma	sup PPF	Dry cavity	40 months	6 weeks	Distal flap atrophy
15	M	L	Chronic infected cavity	sup PPF	Draining cavity	12 months	-	Total flap atrophy
81	F	L	COM with cholesteatoma	sup PCF	Dry cavity	10 months	8 weeks	
14	M	R	COM with cholesteatoma	sup PPF	Dry cavity	8 months	8 weeks	
9	F	R	Chronic infected cavity	sup PCF & inf PPF	Dry cavity	7 months	10 weeks	
31	M	R	COM with cholesteatoma	sup PPF	Dry cavity	17 months	8 weeks	Distal flap atrophy
35	F	R	COM with cholesteatoma	sup PCF & sup PPF	Dry cavity	9 months	6 weeks	Distal flap atrophy
13	F	L	Chronic infected cavity	sup PPF	Dry cavity	6 months	8 weeks	Distal flap atrophy
43	M	R	COM with cholesteatoma	sup PPF	Dry cavity	36 months	8 weeks	
27	M	L	COM with cholesteatoma	sup PPF	Dry cavity	9 months	8 weeks	

M = male; F = female; L = left; R = right; sup = superior pedicle; inf = inferior pedicle; PPF = postauricular pericranial flap; PCF = postconchal soft tissue flap

attic and aditus area. There was a case of total flap atrophy resulting in a discharging ear. The new cavity was finally in round shape, easily accessed and cleaned. No wet accumulated keratin was reported during the follow-up period, except in the single case of total flap atrophy.

## Discussion

Although the normal shape and size of the external ear canal is preserved, canal wall up mastoidectomies have a significant number of retraction and recurrent diseases<sup>(10,11)</sup>. This may be the result of poorly aerated mastoid cavity and inadequate disease removal. Therefore, the canal wall up mastoidectomy needs a second operation. Removal of the posterior canal wall allows a good exposure with a high chance of total disease eradication. If it were necessary, the authors would not hesitate to remove the posterior canal wall to get all the disease out. The mastoid cavity, if not obliterated, can result in a chronic draining cavity associated with chronic recurrent infection and keratin accumulation. This situation is very difficult to control and needs for frequent cleaning. Because of the exposed vesibular organ, the patients usually experience troublesome moments of vertigo during the ear suction procedures. The draining cavity also causes difficulty in the use of a hearing aid with water intolerance. Obliterating the mastoid cavity with healthy viable tissue will help the new external ear canal to remain dry, round, near normal shape and size and easily accessible for follow-up purposes<sup>(7,12)</sup>. It restored the ear canal not only anatomically but also functionally in resonance frequency<sup>(13)</sup>.

Many techniques of mastoid obliteration have been reported from the first one of the soft tissue flap reported by Mosher<sup>(9)</sup>. Other techniques included either local flaps or free grafts such as temporalis muscle, temporoparietal fascia, musculoperiosteum, cartilage, bone pate', pre-planned en bloc posterior bony canal wall, and synthetic material such as hydroxyapatite<sup>(14)</sup>.

Synthetic material and bone pate' had been used successfully to obliterate the mastoid bowl. It could provide a sufficient amount of content before covering of viable tissue such as the Palva flap, the periosteal-pericranial flap and the pre-planned en bloc posterior canal wall<sup>(2-4)</sup>. However, it might be difficult to detect the residual or recurrent disease underneath and may require imaging for following the condition in the obliterated mastoid<sup>(4)</sup>.

Postconchal soft tissue flap was sometimes enough for a small sclerotic mastoid cavity. While the

post auricular pericranial flap contains more amount of soft tissue to obliterate the mastoid cavity especially in the attic, the sinudural angle, the antrum and the mastoid tip. Combining use of both flaps would enhance the size of the tissue flap but may still not be enough for totally obliteration in the big mastoid cavity to reach the normal shape and size of the external ear canal. However, they would help to down size and reshape the mastoid cavity to be part of the new healthy external ear canal. Both flaps can be designed with the pedicle located on the opposite site when they were used simultaneously. Care must be taken to totally remove the cholesteatoma matrix from the mastoid cavity and mobilize the free edge of the canal skin to cover over the obliteration flap. Free temporalis facial graft may be used to act as a bridge for the canal skin to migrate over the junction with the flap by inserting it under the canal skin of one side and allowing it to lie over the flap of the other side.

Substantial shrinkage of obliteration flaps could be noticed in six cases of the presented patients after the 6-months follow-up period. This implied that postconchal soft tissue and postauricular pericranial flaps might not be robust enough to maintain their volumes in long term. The histopathological fate study of tissues used for mastoid obliteration showed that fat and bone chips or pate' retained their bulk and identity whereas subcutaneous tissue and muscle did not<sup>(15)</sup>. Fat augmentation under the flap may help to maintain the bulkiness of the obliteration while still retaining the soft wall for observing the residual or recurrent disease.

Because the new external ear canal was reconstructed with soft tissue, it would be easy to follow the disease underneath. With simple microscopic examination, the authors could observe the new posterior canal wall and look for any abnormality or sign of recurrence, such as bulging, fistula, or drainage during the follow-up period.

The followings are the advantages of the mastoid obliteration with the authors' technique

1. Canal wall-down mastoidectomy provide a good exposure to remove all the disease
2. A reliable flap could be taken from the surgical site without morbidity
3. Combining use of both flaps provide a substantial amount of tissue for obliterating the mastoid cavity.
4. The procedure is in a single stage and postoperative follow-up is feasible with simple otological examination.



## Conclusion

Postconchal soft tissue and postauricular pericranial flap were reliable for mastoid obliteration. It could be achieved in a single stage and resulted in a round dry cavity with healthy soft tissue and skin coverage. The cavity could be simply accessed, cleaned, and examined for the recurrent disease during the follow-up period. Some shrinkage of the flap could be expected in 40% of the cases after six months.

## Potential conflicts of interest

None.

## References

1. Gantz BJ, Wilkinson EP, Hansen MR. Canal wall reconstruction tympanomastoidectomy with mastoid obliteration. *Laryngoscope* 2005; 115: 1734-40.
2. Ramsey MJ, Merchant SN, McKenna MJ. Postauricular periosteal-pericranial flap for mastoid obliteration and canal wall down tympanomastoidectomy. *Otol Neurotol* 2004; 25: 873-8.
3. McElveen JT Jr, Chung AT. Reversible canal wall down mastoidectomy for acquired cholesteatomas: preliminary results. *Laryngoscope* 2003; 113: 1027-33.
4. Hussain A, Ram B, Hilmi OJ. Reconstruction of mastoid cavity with hydroxyapatite cement and postauricular flap. *Laryngoscope* 2002; 112: 583-5.
5. Hartwein J, Hormann K. A technique for the reconstruction of the posterior canal wall and mastoid obliteration in radical cavity surgery. *Am J Otol* 1990; 11: 169-73.
6. Takahashi H, Iwanaga T, Kaieda S, Fukuda T, Kumagami H, Takasaki K, et al. Mastoid obliteration combined with soft-wall reconstruction of posterior ear canal. *Eur Arch Otorhinolaryngol* 2007; 264: 867-71.
7. O'Sullivan PG, Atlas MD. Use of soft tissue vascular flaps for mastoid cavity obliteration. *Laryngoscope* 2004; 114: 957-9.
8. Palva T. Mastoid obliteration. *Acta Otolaryngol Suppl* 1979; 360: 152-4.
9. Mosher HP. A Method of filling the excavated mastoid with a flap from the back of the auricle. *Laryngoscope* 1911; 21: 1158-63.
10. Syms MJ, Luxford WM. Management of cholesteatoma: status of the canal wall. *Laryngoscope* 2003; 113: 443-8.
11. Charachon R, Gratacap B, Tixier C. Closed versus obliteration technique in cholesteatoma surgery. *Am J Otol* 1988; 9: 286-92.
12. Saunders JE, Shoemaker DL, McElveen JT Jr. Reconstruction of the radical mastoid. *Am J Otol* 1992; 13: 465-9.
13. Jang CH. Changes in external ear resonance after mastoidectomy: open cavity mastoid versus obliterated mastoid cavity. *Clin Otolaryngol Allied Sci* 2002; 27: 509-11.
14. Mehta RP, Harris JP. Mastoid obliteration. *Otolaryngol Clin North Am* 2006; 39: 1129-42.
15. Linthicum FH Jr. The fate of mastoid obliteration tissue: a histopathological study. *Laryngoscope* 2002; 112: 1777-81.

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## การผ่าตัดปิดโพรงกระดูกมาสตอยด์ด้วยเนื้อเยื่ออ่อนหลังใบหู และเยื่อหุ้มกะโหลกหลังหู

วีระชัย ตันตินิกร, ปารยะ อาศนะเสน, ศรัญ ประกายรุ่งทอง

**วัตถุประสงค์:** เพื่อรายงานเทคนิคและผลลัพธ์การผ่าตัดปิดโพรงกระดูกมาสตอยด์ด้วยเนื้อเยื่ออ่อนหลังใบหู และเยื่อหุ้มกะโหลกหลังหู

**วัสดุและวิธีการ:** สอบทานย้อนหลังเวชระเบียนผู้ป่วยที่ได้รับการผ่าตัดปิดโพรงกระดูกมาสตอยด์ด้วยเนื้อเยื่ออ่อนหลังใบหู และเยื่อหุ้มกะโหลกหลังหู ซึ่งทำต่อเนื่องภายหลังการผ่าตัดเปิดโพรงกระดูกมาสตอยด์ชนิดล้มผนังด้านหลังของช่องหู ผู้ป่วยทั้งหมดได้รับการผ่าตัดโดยผู้นิพนธ์ลำดับที่หนึ่ง ณ ภาควิชาโสต นาสิก ลาริงซ์วิทยา คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล ตั้งแต่เดือนมกราคม พ.ศ. 2547 ถึงเดือนมกราคม พ.ศ. 2551

**ผลการศึกษา:** พบผู้ป่วยทั้งหมดจำนวน 15 ราย ผลการผ่าตัดในผู้ป่วยทุกรายให้ผลดี ผู้ป่วยมีช่องโพรงหูชั้นนอกที่แห้งสะอาด ยกเว้นในผู้ป่วย 1 ราย ที่มีปัญหาช่องโพรงหูชั้นนอกชื้นและอักเสบเรื้อรังจากปัญหาติดเชื้อและคั่งค้างของซีโกลผิวหนัง เนื่องจากมีการฝ่อตัวทั้งหมดของเนื้อเยื่อที่ใช้ปิด ผู้ป่วย 5 ราย (ร้อยละ 33) ตรวจพบมีการฝ่อตัวบางส่วนบริเวณส่วนปลายของเนื้อเยื่อที่ใช้ปิดหลังการผ่าตัดไปแล้ว 6 เดือน ทำให้เกิดแอ่งเล็กๆ บริเวณ *attic* และ *aditus*

**สรุป:** เนื้อเยื่ออ่อนหลังใบหู และเยื่อหุ้มกะโหลกหลังหูสามารถใช้เพื่อวัตถุประสงค์ในการผ่าตัดปิดโพรงกระดูกมาสตอยด์ได้ดี โพรงหูชั้นนอกที่เกิดขึ้นใหม่จะเป็นรูปทรงกลมมน แห้ง และมีสุขภาพดี สามารถตรวจทำความสะอาดและเฝ้าระวังการเกิดปัญหาซ้ำได้โดยง่าย การฝ่อตัวบางส่วนของเนื้อเยื่อสามารถคาดการณ์ได้ล่วงหน้า และมักเกิดขึ้นบริเวณส่วนปลายของเนื้อเยื่อหลังการผ่าตัด 6 เดือนไปแล้ว

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